CLAIMS

What is claimed is:

1. A method for etching a layer through a photoresist mask with an ARC layer between the layer to be etched and the photoresist mask over a substrate, comprising:

placing the substrate into a processing chamber;

providing an ARC open gas mixture into the processing chamber, wherein the ARC open gas mixture comprises:

an etchant gas; and

a polymerization gas comprising CO and CH_3F;

forming an ARC open plasma from the ARC open gas mixture;

etching the ARC layer with the ARC open plasma until the ARC layer is opened; and

stopping the ARC open gas mixture before the layer to be etched is completely etched.

2. The method, as recited in claim 1, wherein ARC open plasma highly selectively etches the ARC with respect to the layer to be etched.

3. The method, as recited in claim 2, wherein the flow rate of CO is at least 150

sccm.

4. The method, as recited in claim 3, wherein the ARC open gas mixture further comprises an etch rate booster, wherein the etch rate booster is O_2.

5. The method, as recited in claim 4, wherein the layer to be etched is a dielectric layer and wherein the etchant gas comprises at least one of an N_2 and H_2 mixture and CF_4.

6. The method, as recited in claim 5, wherein combined thicknesses of the seed silicon layer and silicon germanium layer is between 10 and 50 nanometers.

7. The method, as recited in claim 6, further comprising providing a photoresist mask over the stack.

8. The method, as recited in claim 7, wherein the photoresist mask is of a 193 or higher generation photoresist.

9. The method, as recited in claim 8, wherein the ARC layer is of an organic material.

10. The method, as recited in claim 2, wherein the ARC layer is of an organic material and wherein the photoresist mask is of a 193 or higher generation photoresist.

11. The method, as recited in claim 1, wherein the ARC layer is of an organic material and wherein the photoresist mask is of a 193 or higher generation photoresist and wherein the ARC open plasma etches the ARC with respect to the layer to be etched with a selectivity greater than 50:1.

12. The method, as recited in claim 11, wherein the flow rate of CO is at least 150 sccm, and wherein the layer to be etched is silicon oxide.

13. The method, as recited in claim 12, wherein the ARC open gas mixture further comprises an etch rate booster, wherein the etch rate booster is O_2.

14. The method, as recited in claim 1, wherein the ARC open plasma does not etch the layer to be etched.

15. The method, as recited in claim 14, wherein the ARC layer is of an organic material and wherein the photoresist mask is of a 193 or higher generation photoresist and the layer to be etched is silicon oxide.

16. A semiconductor device formed by the method of claim 1.

17. An apparatus with computer readable media for performing the method of claim 1.

18. A method for forming a semiconductor device, comprising:

placing a layer to be etched over a substrate;

forming an organic ARC layer over the layer to be etched;

forming a photoresist mask over the ARC layer;

placing the substrate into a processing chamber;

providing an ARC open gas mixture into the processing chamber, wherein the ARC open gas mixture comprises:

an etchant gas; and

a polymerization gas comprising CO and CH_3F;

forming an ARC open plasma from the ARC open gas mixture;

etching the ARC layer with the ARC open plasma until the ARC layer is opened;

stopping the ARC open gas mixture, so that none of the layer to be etched is etched by the ARC open plasma;

providing an etch plasma different than the ARC open plasma; and

etching the layer to be etched with the etch plasma.

19. The method, as recited in claim 18, wherein the ARC open gas mixture further comprises an etch rate booster, wherein the etch rate booster is O_2.

20. The method, as recited in claim 4, wherein the layer to be etched is a dielectric layer and wherein the etch plasma is formed from an etchant gas comprising at least one of an N_2 and H_2 mixture and CF_4.